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TECHNICAL BULLETIN

Application of 250.50, Grounding Electrode System and 250.52 (A) (3) Concrete-Encased Electrode

September 9, 2005

The 2005 National Electrical Code (NFPA 70-2005), adopted by the State of New Hampshire on July 1, 2005, clarifies that all qualifying concrete-encased electrodes are to be used as part of the grounding electrode system for a building or other structure's electrical system unless the building or other structure is existing. **The requirement does not mandate that a concrete encased electrode be installed**, but that it is used when one is present as part of the building or other structures engineering design or actual construction.

As described in 250.52 (A) (3) a qualifying electrode:

1. Is encased by at least 2" of concrete and located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth.
2. Consists of at least 20'of bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods that are not less that ½" in diameter.
    a. In our interpretation, multiple rods or bars that total at least 20' in length are included.
    b. The bars or rods shall be permitted to be bonded together by the usual tie wires or other effective means.

Additionally:

3. No encapsulating non-conductive coatings, such as epoxy, are used for corrosion protection.
4. No vapor barriers or insulating material that effectively isolate the concrete footing or foundation from the earth have been used.

This requirement is for new construction of buildings or other structures that have been designed to the 2005 National Electrical Code or are "design/build" and permitted after July 1, 2005. The requirement does not apply to buildings or other structures that were approved to the 2002 or previous National Electrical Codes or to existing buildings or other structures where just the service or other supply system is being upgraded. It would, however, apply to an existing building or other structure where the construction of an addition, etc., involves a qualifying electrode and the service or other supply system is being upgraded as part of the construction.

Where the above described electrode exists, the connection of a 4 AWG or larger copper grounding electrode conductor to the steel electrode must be made using a device that is listed by an approved testing agency with respect to its suitability for concrete encasement, if installed within the foundation or footing, for direct burial where applicable and for connection to a steel reinforcing rod or bar.

There are several ways of making a connection to the electrode itself and the method of choice will be a matter of design and coordination. The following illustrations and explanations are intended to aid in understanding some common methods of connection and are not intended to be all inclusive.

Figure 1: illustrates a 4 AWG or larger copper grounding electrode conductor that is insulated and has been connected directly to the electrode within the foundation or footing. The connection fitting must be suitable for concrete encasement and for attachment to the steel rod or bar. Sufficient conductor length must be left to exit the wall in a convenient location for future connection by an irreversible connector, the exothermic welding process or to be run directly to the appropriate equipment. The insulation on the conductor will protect it from corrosion where it exits the concrete.

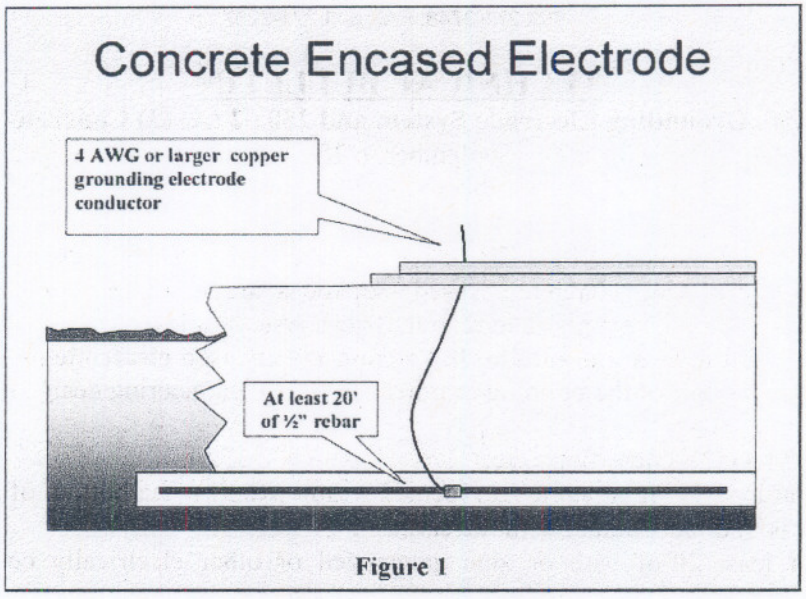

Figure 1

Figure 2: illustrates the same application as Figure 1 except a bare 4 AWG or larger copper grounding electrode conductor has been used. In this case, a Rigid Nonmetallic Conduit (PVC) sleeve filled with material satisfying the requirements of Section 110.11 has been installed. Filling the sleeve prevents the bare conductor, the concrete and the air from contacting each other where the conductor exits the wall protecting it from corrosion. Other methods of providing corrosion protection may also be used. As permitted in Section 250.64 (A), a grounding electrode conductor can be solid, stranded, insulated, covered or bare.

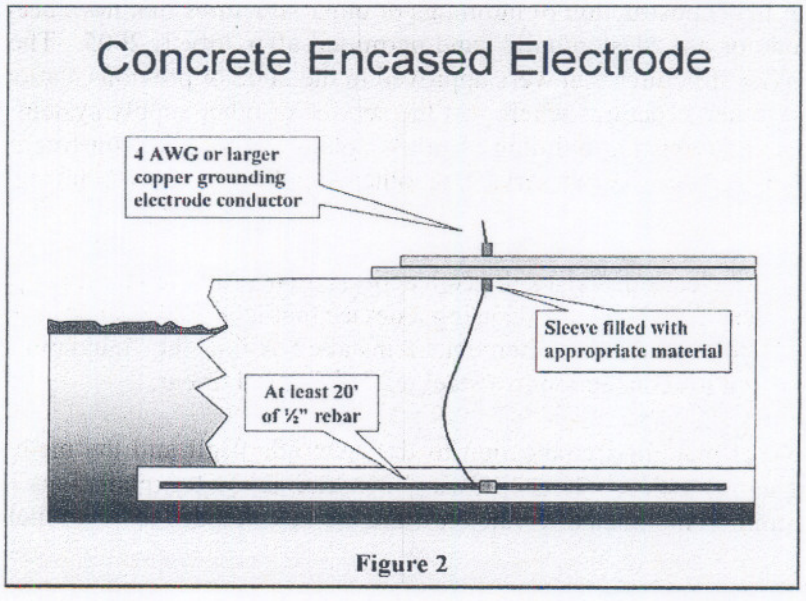

Figure 2

Figure 3: illustrates an application where a rod or bar has been extended up through the concrete wall and sill plate. This bar or rod will be left long enough to extend through the double plate and allow the connection of the grounding electrode conductor. The advantages to this method are that the electrician can make the connection to the rod or bar at any convenient time and it allows for future inspection of the connection. Suitable corrosion protection, such as epoxy, has been provided for the rod or bar where it exits the concrete.

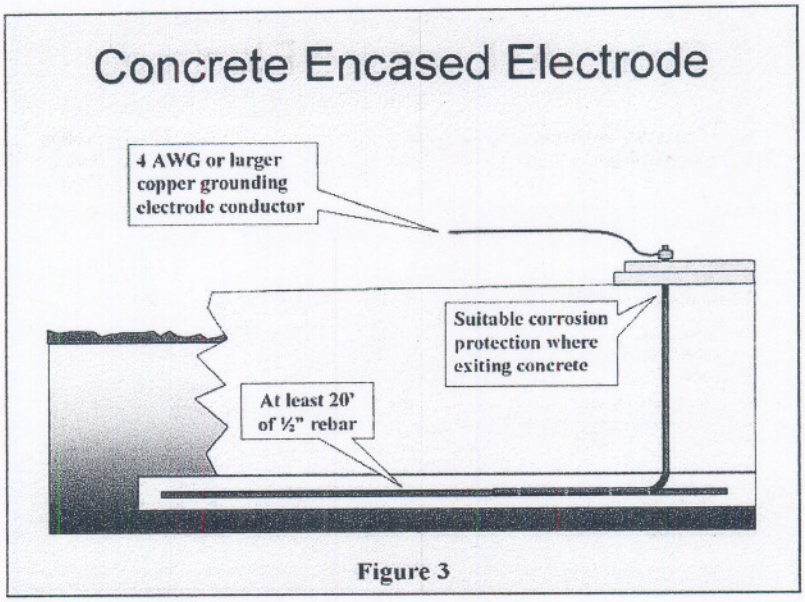

Figure 3

Figure 4: illustrates an application where the rod or bar exits through the footing and the connection of the 4 AWG or larger grounding electrode conductor to the electrode will be below or within the concrete floor. As in Figures 1 and 2 above, the connection fitting must be suitable for concrete encasement if it is within the floor or for direct burial if below the floor and for connection to the steel rod or bar.

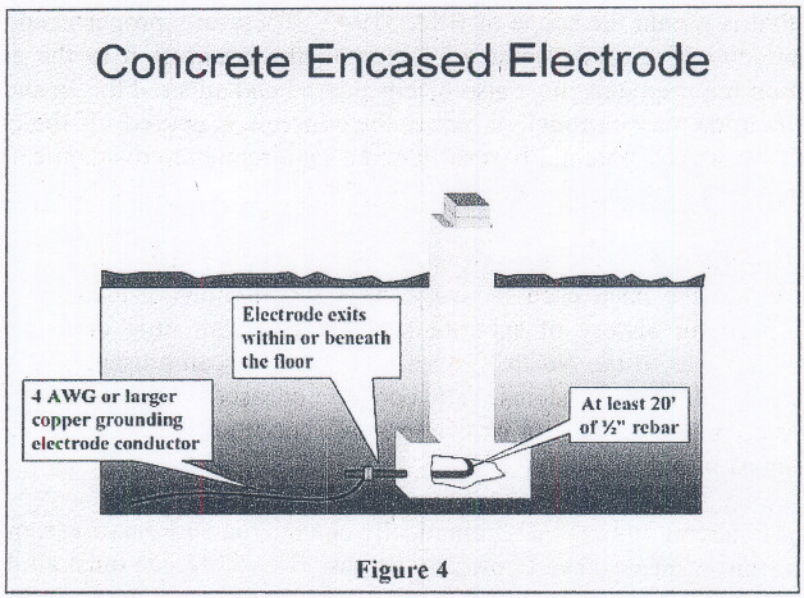

Figure 4

Figure 5: illustrates an application where the electrode exits through the top of the footing. Similar to the installation described in Figure 3, the advantages to this method are that the electrician can make the connection to the rod or bar at any convenient time and it allows for future inspection of the connection. Suitable corrosion protection, such as epoxy, has been provided for the rod or bar where it exits the concrete.

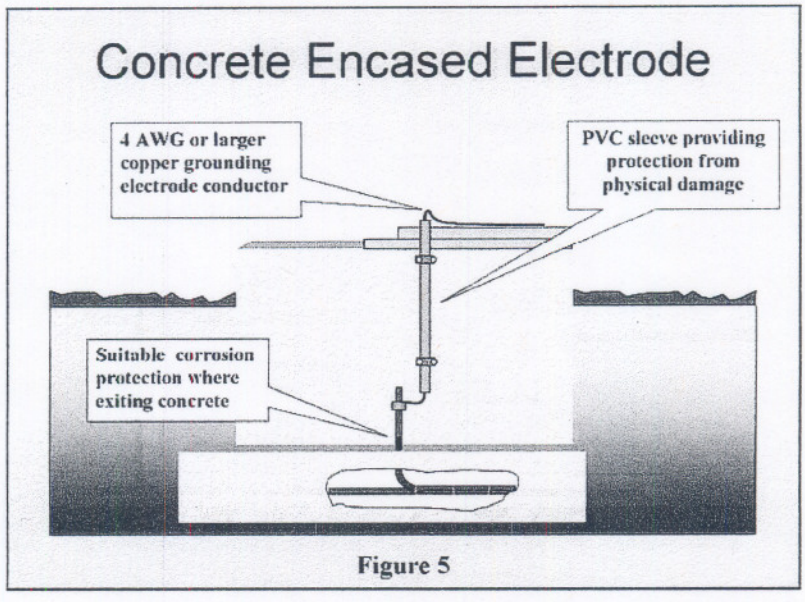

Figure 5

As noted above, these applications are not all inclusive and are only intended to describe some common options. Through careful planning, coordination of trades and the influence of ingenuity other methods can be developed and utilized.

The installation of a grounding electrode conductor, in this case to a concrete encased electrode, is part of an electrical installation that is within the scope of RSA 319-C. Therefore, proper licensure is required for the installation of the grounding electrode conductor including the connection to the electrode itself. Local permitting and inspection requirements must also be considered and adhered to. In short, this may mean that an inspection of the electrode may be required before the concrete is poured. If the process is not followed the consequences could be severe, potentially resulting in a requirement to dismantle and rebuild a portion of the foundation or footing.

Concrete-encased electrodes were developed over 50 years ago as a means of grounding ammunition bunkers in the desert and have been used in many other jurisdictions around the country for grounding electrical systems with a long history of superior performance with little or no maintenance. The soil conditions found in many areas of the North Eastern United States can present a significant challenge with respect to the grounding of electrical systems. The concrete encased electrode with its proven reliability in difficult soil conditions represents a superior choice for these conditions. With that being said, the mandated use is clearly in the interest of public safety.

The implementation of this requirement will dramatically change the coordination required between building trades and inspections from what we have known in the past. Therefore, we must all do our part to make the application as smooth as possible.